

Fitting financial phase-type jump diffusions

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Abstract

Many calculations of option prices etc. in finance require the log-price of the risky asset to be governed by Brownian motion superimposed with compound Poisson jumps in both directions, with the jump sizes having phase-type distributions. The special case of hyperexponential jumps plays a central role. Fitting such a process often involves the intermediate step of fitting a parametric Levy process to data, either by calibration or from historical data. We demonstrate how to obtain likelihood-based fits to a general Levy process subject to certain complete monotonicity assumptions on its Levy density. A main tool is the EM algorithm applied to a truncated and normalised version of the Levy density. Direct fitting to financial log-returns is also discussed, as the presented method provides suitable initial parameters for this purpose. Examples of fitting to classical Lévy processes as well as to real financial time series are presented.

Keywords: barrier option, complete monotonicity, EM algorithm, hyperexponential distribution, Kullback–Leibler divergence, Levy process, Wiener–Hopf factorization

References

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